RESPIRATORY MEDICINE (1999) 93, 919–922

RESPIRATORY MEDICINE

Reports

Early house moves, indoor air, heating methods and asthma

R. C. M. JONES*, C. R. HUGHES†, D. WRIGHT‡ AND J. H. BAUMER§

*The Roborough Surgery 1, Eastcote Close,
†Estover Health Centre, Estover,
‡Department of Mathmatics and Statistics, University of Plymouth and
§Derriford Hospital, Plymouth, U.K.

Objectives: To assess whether house moves or certain housing conditions are a risk factor for the development of childhood asthma.

Design: A case-control study of asthmatic and non-atopic children aged 4–16 years.

Subjects: One hundred children with confirmed asthma in a group general practice of 11 000 patients in Plymouth, U.K. Each was matched by age and gender with a child with no history of wheeze, eczema or hay fever.

Main outcome measures: House moves and main heating methods, prior to the age of onset of asthma in cases and controls.

Results: There was a non-significant association between early house moves and the subsequent development of asthma. No association was found with heating methods, except for ducted-air heating which, because of the small numbers involved could have occurred by chance. None of the other factors studied affecting indoor air showed an association.

Conclusion: Moving house at an early age may increase the risk of developing asthma, or may be associated with other more important risk factors, such as increased general mobility and hence, exposure to viral infections. Heating methods or other factors likely to affect the indoor air quality in early life were not useful predictors of subsequent asthma in children.

RESPIR. MED. (1999) 93, 919–922

Introduction

The increasing prevalence of asthma has yet to be fully explained. A recent study has emphasized the importance of the genetic component (1). Evidence that outdoor air pollution is implicated is sparse (2,3) and studies of indoor air have yielded conflicting results. The presence of damp, mould, bacteria and house-dust have been associated with asthma in some studies (4,5). Poor ventilation of centrally heated houses has been suggested as a cause of increasing allergy, but it is difficult to measure directly and no firm conclusions have been drawn. Heating methods may affect ventilation, but were not shown to be relevant in the Highlands of Scotland (5) and conflicting results come from other studies (6,7).

In a previous case-control study in Plymouth (8), house moves before the onset of asthma were strongly associated with subsequent asthma in children, but house moves after asthma onset showed no such association. Data from various sources were analysed by Strachan *et al.* (9), who concluded that moving house at any time in childhood was not strongly associated with asthma. Data from the British 1958 National Birth Cohort study showed a small, but significant, association between moves and reported asthma (10) and a recent study in the Highlands of Scotland showed a non-significant trend with respect to reported wheeze (5). We have repeated our earlier study in a larger practice in Plymouth, with a wider range of housing types and social class, and have expanded it to assess heating methods and other factors affecting indoor air quality.

Received 15 January 1999 and accepted in revised form 9 July 1999.
Correspondence should be addressed to Dr. R. Jones, Roborough, Plymouth, PL6 6PH, U.K.

Subjects and methods

The practice has 11 000 patients in the northern suburbs of Plymouth and includes some patients in adjacent Dartmoor villages. One hundred patients were chosen from 209 patients aged 4–16 years on the practice asthma register, (the list was in order of practice computer number and

0954-6111/99/120919+04 $12·00/0

alternate names were taken, but only one case being taken from each family). The register consists of patients in whom a clinical diagnosis for asthma has been made supported by a response to treatment and/or peak-flow measurement, according to the British Thoracic Society Guidelines (12). All had received asthma treatment within the last year. Each selected child with asthma was matched by age and gender with a control child, who had no recorded history of wheeze, eczema or hay fever. At interview with the patients it was confirmed that there had been no symptoms of atopic disorders. The data was collected between May and October 1996.

Questionnaires were administered by telephone by the practice asthma nurse, or if not available by phone, by a visit from a health visitor. Only one parent refused to participate. Where possible, information was checked with the child's primary care record. Details were recorded of asthma onset data, infant feeding methods, birth order, personal and family history of atopic disorders, parental smoking, smoking in pregnancy, parental separation, social class of main earner in the family and use of child minding in the first 3 years. The number of homes lives in was recorded, including dates of moves, age of the homes, type of housing (i.e. house, bungalow or flat), heating methods, structural repairs, dampness and presence of pets (dog, cat, bird or rodent). The data of onset of asthma was taken as the age reported by the parents, unless the date in the primary care record was earlier.

Heating methods were reported according to the main winter heating method, categories being central heating, gas heater, open fire, electric storage heaters, other electrical heating, ducted air and miscellaneous. Heating method was also categorized by whether or not it improved ventilation in the house.

Sample size was computed on the basis of the Plymouth study (9) in which 86% of the cases moved house compared to 41% of the controls. To detect this difference with a power of 80% at the 5% significance level would require 21 in each group. In order to detect clinically significant differences in the other factors studied, a sample size of 80–100 was required, for example the difference between 20% presence in the controls and 40% in the cases would need 91 in each group. Statistical analysis was performed by D.W. The effect of house moves before the onset of asthma was tested using McNemar's test for matched pair analysis and multiple logistic regression analysis was used to examine the relationship between other factors, such as heating methods, and to obtain adjusted odds ratios.

Results

The median age of asthma onset was 3 years 3 months, with a range of 1 month to 14 years 10 months. The mean number of total house moves in both groups was 2·8, range 0–11.

There was no significant difference between asthma cases and controls with respect to any house move prior to the age of onset of asthma (odds ratio (OR) 1·12; 95% confidence intervals (CI) 0·89–1·41) nor in the number of house moves made, using McNemar's test for matched pairs, (see Table 1). No significant difference was found with respect to dampness, structural repairs, age of home, birth order, parental smoking, smoking in pregnancy or presence of pets. Child-minding before 3 years of age occurred in 14% of both cases and controls, mean hours per week in those families using a childminder being 28 and 39 respectively.

Multiple logistic regression analysis showed no association between the subsequent development of asthma and house heating method prior to the onset of asthma, nor with those heating methods associated with poor

TABLE 1. House moves and other factors studied in 100 matched pairs of asthmatic and control children, before the onset of asthma, (the figures are both true numbers and percentages)

House moves	Asthma ($n=100$)	Controls	Odds ratio
Not moved house	41	53	0·62
1 house move	37	27	1·59
2 house moves	9	8	1·14
3 house moves	5	9	0·53
4 or more house moves	8	3	2·81
Other factors			
Smoking in pregnancy	22	26	0·80
Mother smoking in house	27	24	1·17
Father smoking in house	39	43	0·85
Parental separation	18	17	1·07
Child minding	14	14	1·00
Cat in house	32	31	1·05
Dog in house	19	25	0·70
Bird in house	8	9	0·88
Rodent in house	11	15	0·70

TABLE 2. The results of various studies addressing the issue of house moves and asthma, both for moves at any stage in childhood and moves before the onset of asthma

Study	No. of cases controls	No. of cases moved (%)	No. of controls moved (%)	Odds ratio	Confidence interval
For house moves at any stage in childhood					
Sheffield (9, 14)	1078	390/548 (71%)	348/530 (66%)	1·29	0·99–1·68
Croydon (9, 15)	573	192/293 (66%)	181/280 (65%)	1·04	0·74–1·47
Birth Cohort (9, 16)	6666	1695/6666 (25%)	448/2009 (22%)	1·14	1·04–1·25
Plymouth (8)	132	38/44 (86%)	36/88 (41%)	11·1	3·5–23·9
For house moves before asthma onset					
Plymouth (8)	132	25/44 (57%)	8/88 (9%)	13·2	5·1–37·3
This study	200	59/100 (59%)	47/100 (47%)	1·12	0·89–1·41

ventilation taken as a group. However, of nine patients living in houses heated by ducted air at the age of onset, eight developed asthma (OR 8·9; CI 1·08–73).

Discussion

A small non-significant association between early house moves and with the later diagnosis of asthma was similar to other studies reporting on house moves at any time in childhood (5,9,10). It was strikingly different from the result of an earlier study in Plymouth (8), which showed an odds ratio of 11·1 (Table 2 and Fig. 1) using identical methodology. This suggests that there were specific confounding factors in the earlier study. An alternative explanation is that the association noted in this practice population, between house moves and asthma, may have occurred by chance: to then test it in the same population may give apparent confirmation to a chance observation, hence the need to test in other populations.

The study is limited by the use of retrospective data obtained by interview about the events and places some years previously. The potential of bias cannot be excluded. However, where possible details obtained at interview were checked against practice records.

The mechanism by which early house moves might be associated is unclear. House moves could exacerbate an allergic tendency, with new allergens being encountered at any early age following a period without contact, for example, cat allergens can persist for 6 months after the cat has left (12). House moves are also likely to be related to greater mobility in general, and hence may lead to increased exposure to viral infection. Other untested factors could be causally associated both with moving house and the subsequent development of asthma.

Much has been made of the role of indoor inhaled allergens in the increasing prevalence of asthma (13). In this study, neither heating methods which affect ventilation, nor factors such as smoking or pets in the house likely to affect indoor aeroallergen load, were associated with later asthma. Moving in to a house with any particular heating method did not increase the risk of developing asthma. The finding of an association between asthma onset and ducted-air heating in a small number of cases merits further consideration, but may well have occurred by chance.

In conclusion, this study has found a much smaller association between early childhood house moves and the subsequent development of asthma than an identical earlier study. This result accords closely to previous data on overall house moves in childhood and asthma, and suggests that moving house in early life may carry a small increase in risk of asthma later (Fig. 1). Heating methods, or other factors likely to affect the indoor air quality in early life, were not useful predictors of future asthma.

References

1. Harris JR, Magnus P, Samuelson SO, Tambs K. No evidence for effects of familial environment on asthma. *Am J Respir Crit Care Med* 1997; **156:** 43–49.
2. A Von Mutius E, Fritzsch C, Weiland SK, Roll G, Magnussen H. Prevalence of asthma and allergic disorders among children in united Germany: a descriptive comparison. *Br Med J* 1992; **305:** 1395–1399.
3. Austin JB, Russell G, Adam MG, Mackintosh D, Kelsey S, Peck DF. Prevalence of asthma and wheeze in the Highlands of Scotland. *Arch Dis Child* 1994; **71:** 211–216.
4. Wickman M, Nordvall SL, Pershagen G, Sundell J, Schwartz B. House dust mite sensitisation in children and residential characteristics in a temperature zone. *J Allergy Clin Immunol* 1991; **88:** 89–95.
5. Austin JB, Russell G. Wheeze, cough, atopy and indoor environment in the Scottish Highlands. *Arch Dis Child* 1997; **76:** 22–26.
6. Burr ML, Miskelly FG, Butland BK, *et al.* Environmental factors and symptoms in infants at high risk of allergy. *J Epidemiol Community Health* 1989; **43:** 125–132.

7. Von Mutius E, Martinez FD, Nicolai T. Skin reactivity tests and coal burning. *J Allergy Clin Immunol* 1995; **95:** 211.
8. Hughes CH, Baumer JH. Moving house: a risk factor for the development of childhood asthma. *Br Med J* 1995; **311:** 1069–1070.
9. Strachan DP, Butland BK, Carey IM, Anderson HR. Moving house unlikely to pose substantial risk of childhood asthma. *Br Med J* 1996; **312:** 315.
10. Kaplan BA, Mascie-Taylor CGN. Biosocial factors in the epidemiology of childhood asthma in a British national sample. *J Epidemiol Community Health* 1985; **39:** 152–156.
11. The British Thoracic Society, The National Asthma Campaign, The Royal College of Physicians of London *et al.* The British Guidelines on Asthma Management 1995 Review and Position Statement. *Thorax* 1997; **52:** S2.
12. Wood RA, Chapman MD, Adkinson NF, Eggleston PA. The effect of cat removal on allergen content in household dust samples. *J Allergy Clin Immunol* 1989; **83:** 730–734.
13. Cullinan P, Newman Taylor AJ. Asthma in children: environmental factors. *Br Med J* **308:** 1585–1586.
14. Strachan DP, Carey IM. The home environment and severe asthma in adolescence: a population based case-control study. *Br Med J* 1995; **311:** 1053–1056.
15. Anderson HR, Butland BK, Strachan DP. Trends in the prevalence and severity of childhood asthma. *Br Med J* 1994; **308:** 1600–1604.
16. Anderson HR, Bland JM, Patel S, Peckham C. The natural history of asthma in childhood. *J Epidemiol Community Health* 1986; **40:** 121–129.